

## § 91.326

GP=the analyzer's standard operating pressure (pascals)

(iii) Calculate the expected dilute NO span gas and water vapor mixture concentration (designated as "D1") by the following equation:

$$D1 = D \times (1 - Z1/100)$$

(iv)(A) The maximum raw or dilute exhaust water vapor concentration expected during testing (designated as Wm) can be estimated from the CO<sub>2</sub> span gas (or as defined in the equation in this paragraph and designated as A) criteria in paragraph (c)(1) of this section and the assumption of a fuel atom H/C ratio of 1.8:1 as:

$$Wm(\%) = 0.9 \times A(\%)$$

Where:

A = maximum CO<sub>2</sub> concentration expected in the sample system during testing.

(B) Percent water quench shall not exceed 3 percent and shall be calculated by:

$$\% \text{ Water Quench} = 100 \times (D1 - AR)/D1 \times Wm/Z1$$

[61 FR 52102, Oct. 4, 1996, as amended at 70 FR 40451, July 13, 2005]

## § 91.326 Pre- and post-test analyzer calibration.

Calibrate the operating range of each analyzer used during the test prior to and after each test in accordance with the following procedure (A chronic need for parameter adjustment can indicate a need for instrument maintenance.):

(a) Make the calibration using a zero gas and a span gas whose nominal value is between 80 percent and 100 percent of full scale, inclusive, of the measuring range.

(b) Use the same analyzer(s) flow rate and pressure as that used during exhaust emission test sampling.

(c) Warm-up and stabilize the analyzer(s) before the calibration is made.

(d) If necessary, clean and/or replace filter elements before calibration is made.

(e) Calibrate analyzer(s) as follows:

(1) Zero the analyzer using the appropriate zero gas. Adjust analyzer zero if necessary. Zero reading should be stable.

(2) Span the analyzer using the appropriate span gas for the range being

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calibrated. Adjust the analyzer to the calibration set point if necessary.

(3) Recheck zero and span set points.

(4) If the response of the zero gas or span gas differs more than one percent of full scale, then repeat paragraphs (e)(1) through (3) of this section.

## § 91.327 Sampling system requirements.

(a) *Sample component surface temperature.* For sampling systems which use heated components, use engineering judgment to locate the coolest portion of each component (pump, sample line section, filters, and so forth) in the heated portion of the sampling system that has a separate source of power or heating element. Monitor the temperature at that location. If several components are within an oven, then only the surface temperature of the component with the largest thermal mass and the oven temperature need be measured.

(b) If water is removed by condensation, monitor the sample gas temperature or sample dew point either within the water trap or downstream. It may not exceed 7 °C.

## § 91.328 Measurement equipment accuracy/calibration frequency table.

(a) The accuracy of measurements must be such that the maximum tolerances shown in Table 2 in appendix A to this subpart are not exceeded.

(b) Calibrate all equipment and analyzers according to the frequencies shown in Table 2 in appendix A to this subpart.

(c) Prior to initial use and after major repairs, bench check each analyzer (see § 91.323).

(d) Calibrate as specified in § 91.306 and §§ 91.315 through 91.322.

(e) At least monthly, or after any maintenance which could alter calibration, perform the following calibrations and checks.

(1) Leak check the vacuum side of the system (see § 91.324(a)).

(2) Verify that the automatic data collection system (if used) meets the requirements found in Table 2 in appendix A to this subpart.

(3) Check the fuel flow measurement instrument to insure that the specifications in Table 2 in appendix A to this subpart are met.

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(f) Verify that all NDIR analyzers meet the water rejection ratio and the CO<sub>2</sub> rejection ratio as specified in §91.325.

(g) Verify that the dynamometer test stand and power output instrumentation meet the specifications in Table 2 in appendix A to this subpart.

### §91.329 Catalyst thermal stress test.

(a) *Oven characteristics.* The oven used for thermally stressing the test catalyst must be capable of maintaining a temperature of 500 ±5 °C and 1000 ±10 °C.

(b) *Evaluation gas composition.* (1) A synthetic exhaust gas mixture is used for evaluating the effect of thermal stress on catalyst conversion efficiency.

(2) The synthetic exhaust gas mixture must have the following composition:

Constituent	Volume percent	Parts per million
Carbon Monoxide <sup>1</sup>	1	.....
Oxygen	1.3	.....
Carbon Dioxide	9	.....
Water Vapor	10	.....
Sulfur Dioxide		20
Oxides of Nitrogen		280
Hydrogen		3500
Hydrocarbon <sup>1,2</sup>		4000
Nitrogen=Balance		.....

<sup>1</sup> Alternatively, the carbon monoxide and hydrocarbon proportions of the mixture may be changed to 1.2% and 4650 ppm, respectively (using on of these alternative concentrations requires that the other be used simultaneously).

<sup>2</sup> Propylene/propane ratio=2/1.

[61 FR 52102, Oct. 4, 1996; 62 FR 20066, Apr. 24, 1997]

## APPENDIX A TO SUBPART D OF PART 91—TABLES

TABLE 1—SYMBOLS USED IN SUBPARTS D AND E

Symbol	Term	Unit
A <sub>YM</sub>	Final weighted emission test results	g/kW-hr
C <sub>3</sub> H <sub>8</sub>	Propane	
C <sub>B</sub>	Concentration of emission in background sample	ppm
C <sub>D</sub>	Concentration of emission in dilute sample	ppm
CO	Carbon monoxide	
CO <sub>2</sub>	Carbon dioxide	
conc	Concentration (ppm by volume)	ppm
D <sub>X</sub>	Density of a specific emission (XX)	g/m <sup>3</sup>
D <sub>XX</sub>	Volume concentration of a specific emission (XX) on a dry basis.	percent
DF	Dilution factor of dilute exhaust.	
D1	Water vapor mixture concentration	percent
f	Engine specific parameter considering atmospheric conditions	
G <sub>AIRD</sub>	Intake air mass flow rate on dry basis	kg/h
G <sub>FUEL</sub>	Fuel mass flow rate	kg/h
GP	Analyzer standard operating pressure	Pa
G <sub>s</sub>	Mass of carbon measured during a sampling period	g
H	Absolute humidity (water content related to dry air)	gr/kg
H <sub>2</sub>	Hydrogen	
i	Subscript denoting an individual mode	
IT	Indicated torque	N-m
K	Wet to dry conversion factor	
K <sub>HI</sub>	Humidity correction factor	
K <sub>V</sub>	Calibration coefficient for critical flow venturi	
M <sub>X</sub>	Molecular weight of a specific molecule(XX)	g/mole
mass	Pollutant mass flow	g/h
M <sub>FUEL</sub>	Mass of fuel consumed during a sampling period	g
N	Pump revolutions during test period	revs
N <sub>2</sub>	Nitrogen	
NO	Nitric oxide	
NO <sub>2</sub>	Nitrogen dioxide	
NO <sub>X</sub>	Oxides of nitrogen	
O <sub>2</sub>	Oxygen	
O <sub>2</sub> I	Oxygen concentration of the burner air	percent
P	Absolute pressure	kPa
P <sub>AUX</sub>	Declared total power absorbed by auxiliaries fitted for the test	kW
P <sub>B</sub>	Total barometric pressure (average of the pre-test and post-test values).	kPa
P <sub>dew</sub>	Test ambient saturation vapor pressure at the dew point	kPa
P <sub>e</sub>	Absolute pump outlet pressure	kPa
P <sub>ED</sub>	Pressure drop between the inlet and throat of metering venturi	kPa
P <sub>i</sub>	P <sub>i</sub> =P <sub>M,i</sub> + P <sub>AUX,i</sub>	